

**ABSTRACT OF THE DISCLOSURE**

Wafer-level electronic packages having waveguides and methods of fabricating chip-level electronic packages having waveguides are disclosed. A representative chip-level electronic package includes at least one waveguide having a waveguide core. In addition, another representative chip-level electronic package includes a waveguide having an air-gap cladding layer around a portion of the waveguide core. A representative method for fabricating a chip-level electronic package includes: providing a substrate having a passivation layer disposed on the substrate; disposing a waveguide core on a portion of the passivation layer; disposing a first sacrificial layer onto at least one portion of the passivation layer and the waveguide core; disposing an overcoat layer onto the passivation layer and the first sacrificial layer; and removing the first sacrificial layer to define an air-gap cladding layer within the overcoat polymer layer and around a portion of the waveguide core.